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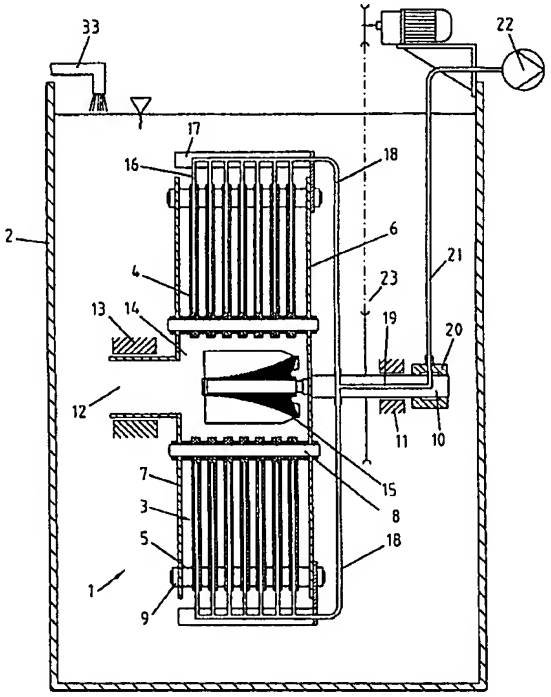
(54) DISPOSITIF DE FILTRATION POUR CLARIFIER DES LIQUIDES CONTAMINES
(54) FILTER DEVICE FOR CLARIFYING CONTAMINATED LIQUIDS

(57)

The filter device (1) is especially used for mechanical cleansing of waste water and for water treatment. It is rotationally arranged in a container (2) and surrounded by the liquid to be filtered. The filter device (1) comprises several filter elements (4) which are arranged at a distance from each other, form segment-shaped filter modules (3) and are assembled to form a rotary filter. The individual filter elements (4) consist of filter plates which are used to divert the filtrate and which are provided with filters on both sides. The aim of the invention is to prevent solids from adhering to the filters during the filtering process. This is achieved by providing the rotary filter with a hollow area (14) that is connected to the container (2) via a suction inlet and which is sealed by means of a carrier plate (6) for the filter segments, and also by making the hollow area (14) cooperate with a flow member. A pump blade wheel is used as a flow member. Preferably, the pump blade wheel (15) is driven via the rotary filter.



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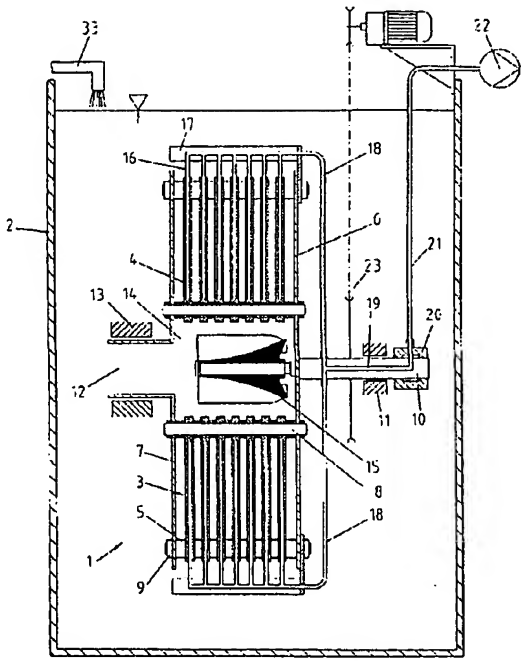
(54) Titre : DISPOSITIF DE FILTRATION POUR CLARIFIER DES LIQUIDES CONTAMINES
(54) Title: FILTER DEVICE FOR CLARIFYING CONTAMINATED LIQUIDS



(57) Abrégé/Abstract:
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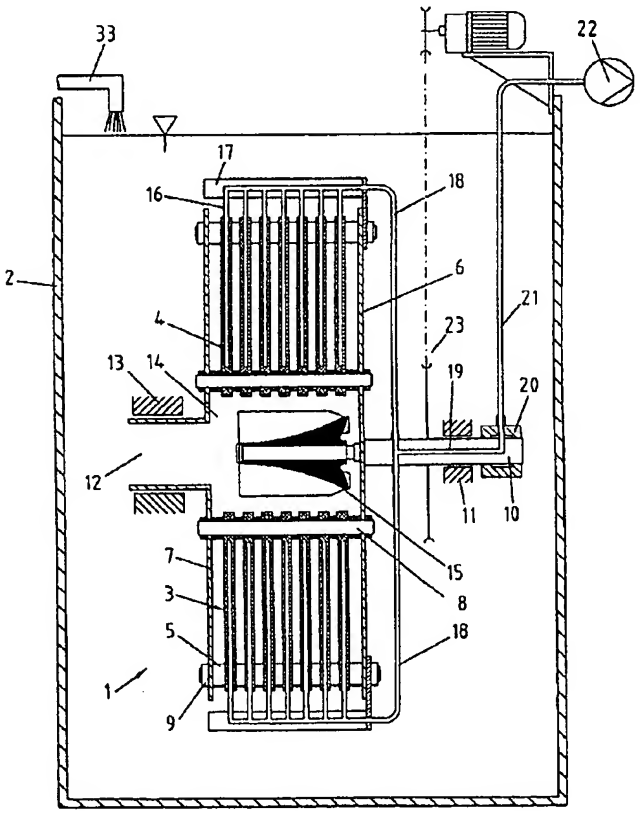
[Fortsetzung auf der nächsten Seite]

(54) Title: FILTER DEVICE FOR CLARIFYING CONTAMINATED LIQUIDS

(54) Bezeichnung: FILTEREINRICHTUNG ZUM KLÄREN VON VERSCHMUTZTEN FLÜSSIGKEITEN



(57) Abstract: The filter device (1) is especially used for mechanical cleansing of waste water and for water treatment. It is rotationally arranged in a container (2) and surrounded by the liquid to be filtered. The filter device (1) comprises several filter elements (4) which are arranged at a distance from each other, form segment-shaped filter modules (3) and are assembled to form a rotary filter. The individual filter elements (4) consist of filter plates which are used to divert the filtrate and which are provided with filters on both sides. The aim of the invention is to prevent solids from adhering to the filters during the filtering process. This is achieved by providing the rotary filter with a hollow area (14) that is connected to the container (2) via a suction inlet and which is sealed by means of a carrier plate (6) for the filter segments, and also by making the hollow area (14) cooperate with a flow member. A pump blade wheel is used as a flow member. Preferably, the pump blade wheel (15) is driven via the rotary filter.

(57) Zusammenfassung: Die Filtereinrichtung (1) wird insbesondere zur mechanischen Abwasserreinigung und Wasseraufbereitung eingesetzt. Sie ist in einem Behälter (2) drehbar angeordnet und von der zu filtrierenden Flüssigkeit umgeben. Die Filtereinrichtung (1) besteht aus mehreren, voneinander beabstandeten Filterelementen (4), die segmentförmige Filtermodule (3) bilden und zu einem Drehfilter zusammengefügt sind. Die einzelnen Filterelemente

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Zur Erklärung der Zweibuchstaben-Codes, und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.

(4) bestehen aus Filterscheiben über die das Filtrat abgeleitet wird und die beiderseits mit Filtern bestückt sind. Aufgabe ist es, zu vermeiden, dass beim Filtervorgang an den Filtern Feststoffe anhaften. Das wird dadurch erreicht, dass das Drehfilter mit einem Hohlraum (14) versehen ist, der einerseits mit dem Behälter (2) über eine Ansaugöffnung (12) verbunden und andererseits durch eine Tragscheibe (6) für die Filtersegmente verschlossen ist, und der Hohlraum (14) mit einem Strömungsglied in Wirkverbindung ist. Als Strömungsglied dient ein Pumpenschaufelrad (15). Vorzugsweise wird das Pumpenschaufelrad (15) über das Drehfilter angetrieben.

Filter device for the clarification of contaminated liquids

The invention relates to filter devices which are used for the clarification of contaminated liquids, in particular in sewage purification and water treatment.

Filter devices of this type consist of a plurality of filter elements which are spaced apart from one another and which are combined into filter modules and are arranged rotatably in a circular or polygonal form of construction in a vessel containing the filter liquid. The filter elements consist of filter disks which are equipped on both sides with filters and which have grooves for discharging the filtrate. At the commencement of the rotational movement of the filter modules in the still stationary filter liquid, a flow resistance occurs on the filter surfaces which initially prevents solids retained on the filter surfaces from being deposited due to the high relative speed between the filter device and the liquid. With an increasing period of rotation of the filter device, however, the initial flow resistance decreases, because the filter liquid is circulated to an increasing extent and the relative speed between the filter device and the liquid becomes lower, so that, as the filter time progresses, what may be referred to as covering layers of solids are formed on the filters and are detrimental to the efficiency of the filter device.

It is known from DE 195 37 578, for the elimination of the filtration-inhibiting covering layer on the filters, to provide on the filters a backwash device consisting of a plurality of suction-extraction bars which bear on the filters on both sides of the filter disk and extend radially from the outside inward. The

individual suction-extraction bars are connected to downpipes and are connected to a suction pump via further pipeline systems. By built-in slides in the downpipes being opened, clarified liquid is forced out of the interior of the filter disks into the suction-extraction bars, in order thereby to free the filter surfaces of the adhering solid layers. If cleaning is insufficient, backwashing may be further reinforced by the connected suction pump. In this cleaning process, the suction-extraction bars cause mechanical wear at the filters and thus impair their useful life. In addition to the backwash device, a device for the intensive cleaning of the filters is also provided. This consists of a set of injection pipes which are extended vertically as far as the hollow shaft and the spray nozzles of which are fed with already clarified liquid by a high-pressure pump. One disadvantage of this is that the clarified liquid used for cleaning the filters, due to being enriched with solids, flows back into the vessel again and undergoes a filter process once more, thus leading to a reduction in filter capacity. The outlay involved in the backwash and intensive-cleaning device in mechanical and control terms is appreciable. The result of discontinuous cleaning is that during the filter process, between the cleaning phases, new covering layers of retained solids are repeatedly formed on the filters and have an adverse influence on the efficiency of the filter process.

Furthermore, EP-A-0 289 674 discloses a filter device which operates according to the centrifuge principle. For this purpose, a hollow shaft, on which filter elements are fastened, spaced apart, next to one another, is rotatably arranged vertically in a closed vessel. The hollow shaft has, below the vessel, an inlet valve for supplying the filter liquid and, above

the vessel, an inlet valve for supplying a backwashing agent. First, with the inlet valve for the backwash closed, filter liquid is introduced into the hollow shaft via the lower inlet valve. As a result of the centrifugal force occurring during rotation, the filter liquid passes through the holes of the hollow shaft and infiltrates between the adjacent filter elements. The centrifugal force causes external pressure to be exerted on the filter disks, so that the filtrate penetrates into the interior of the filter disks, is discharged on the periphery of the disks by means of pipelines and is intercepted in a trough above the closed vessel, from where it can flow away. During the filter operation, even here, filtration-inhibiting covering layers are formed on the filter surfaces and, as the filter time progresses, inhibit the filter process. Backwashing is therefore regularly necessary. The supply of filter liquid is interrupted for the time of the backwash and a backwashing medium is introduced under high pressure into the hollow shaft via the inlet valve for the backwash, which backwashing medium consists of either clear filtrate, air or gas and flows out via the holes in the hollow shaft between the adjacent filter disks and thus eliminates the filtration-inhibiting covering layers from the filter surfaces. The backwash entails a relatively high technical outlay. Moreover, the efficiency of the filter process is impaired.

The object on which the invention is based is, while avoiding the disadvantages of the prior art, to provide a filter device for the clarification of contaminated liquids, by means of which automatic, continuous and wear-free cleaning of the filters is achieved and which thus prevents the situation where, during the filter operation, filtration-inhibiting solid deposits (covering layers), which have an adverse influence on

the filter process, are formed on the filters.

The object is achieved, according to the invention, in that the filter modules form centrally a cavity which on one side is closed by means of a carrying disk and on the other side is connected to the vessel via a suction-intake orifice, and in that the cavity is connected operatively to a flow member in such a way that, via the suction-intake orifice, a flow can be generated in the unclarified liquid between the spaced-apart filter elements and avoids an adhesion of solids to the filter elements.

As a result, constant flow resistance is generated due to the swirling of the unclarified liquid between the adjacent filter elements, and automatic, continuous and wear-free cleaning of the filters is brought about without any mechanical action. Filtration-inhibiting covering layers due to solid deposits on the filters thus remain avoided, so that the filtration efficiency is improved. Only the unclarified liquid in the vessel serves for the cleaning process, so that already clarified liquid no longer has to be returned into the filter circuit, with the result that the filter capacity is increased, as compared with conventional filter devices. The invention can be implemented without a high technical outlay and at low costs and, moreover, is maintenance-friendly. Expediently, the filter modules are lined up on rods and are supported, on the one hand, in a bearing via a driveshaft connected firmly to the carrying disk and, on the other hand, in a bearing via a bearing flange having the suction-intake orifice.

Advantageously, the flow member is designed as a pump vane wheel and is connected to a driveshaft via the carrying disk connected to the filter modules. A pump action is thereby generated at the same time by means

of the filter device and during the filter operation causes an intensive flow of the filter liquid through between the spaced-apart filter elements, with a cleaning effect taking place simultaneously. By virtue of the integrated pump vane wheel, a separate drive becomes unnecessary and the costs are reduced.

According to a further feature of the invention, an axial vane wheel connected to a separate motor is arranged in the suction-intake orifice of the bearing flange. Consequently, the rotational speed of the flow member can be regulated, irrespective of the rotational speed of the filter device, and the flow velocity of the filter liquid on the filter surfaces can thus be controlled.

According to another feature, there is provision for a flow duct to be inserted through the suction-intake orifice of the bearing flange and to be fastened in a support bearing, the flow duct being connected, on the one hand, to the vessel by means of a suction-intake orifice and, on the other hand, to the cavity by means of a slot-shaped orifice. As a result, an even higher flow velocity can be achieved between the filter elements and the cleaning effect can be further intensified.

Finally, according to a last feature, there is provision for a flow duct to be inserted through the suction-intake orifice of the bearing flange and to be fastened in a support bearing, the flow duct being connected by means of a suction-intake orifice to a pipeline which issues with a suction-intake orifice below the filter device on the vessel, and a liquid pump being integrated into the pipeline.

The invention will be explained in more detail below by means of an exemplary embodiment. In the accompanying drawing:

fig. 1 shows a diagrammatic illustration of the filter

device with a pump vane wheel,

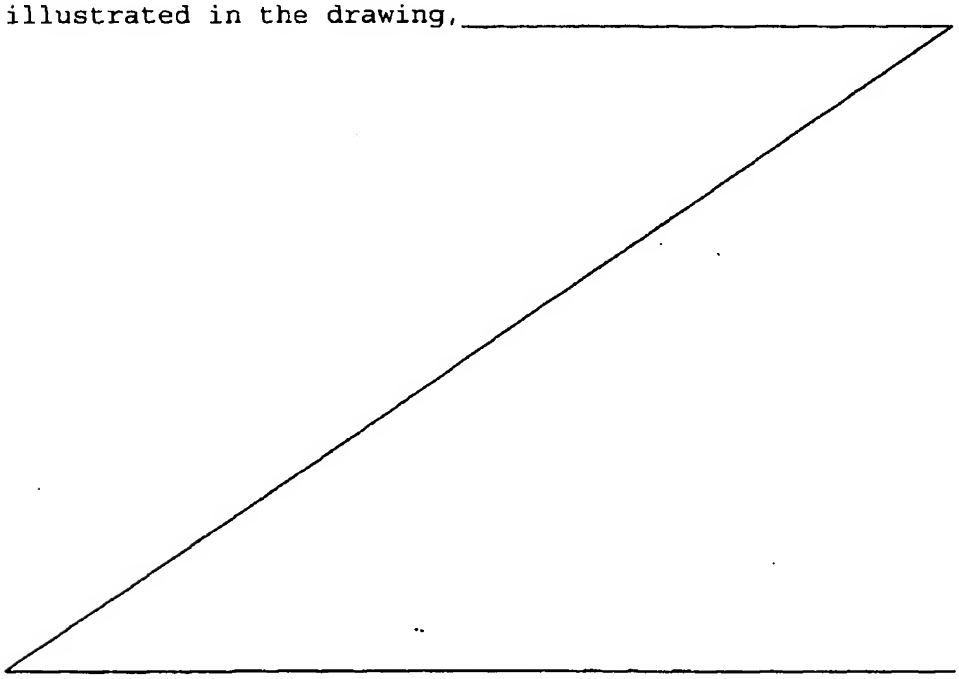
fig. 2 shows a design variant with a separately driven axial vane wheel,

fig. 3 shows a design variant with a built-in flow duct and possible arrangements of the flow members,

fig. 4 shows a design variant with a flow duct and an integrated pump,

fig. 5 shows a section along the line I-I according to fig. 3.

The filter device 1 is accommodated rotatably in a vessel 2 containing the filter liquid. In this case, a plurality of filter modules 3 are arranged circularly. The filter modules 3 are composed of individual filter elements 4 with a spacing of preferably 4 to 8 mm. The filter elements 4 consist of known filter disks, not illustrated in the drawing,



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pump 22. The filter device 1 is connected to a chain drive 23 via the driveshaft 10 (fig. 1).

In a further design possibility according to fig. 2, there is provision for an axial vane wheel 24, which is driven separately via a motor 25, to be arranged in the suction-intake orifice 12 of the bearing flange 7.
In an embodiment according to fig. 3, a flow duct 26 is pushed in the suction-intake orifice 12 and has a suction-intake orifice 27 which is fastened to a support bearing 28. The cavity 14 is in this case connected to the suction-intake orifice 27 via a slot-shaped orifice 29. Both a pump vane wheel 15 and a motor-driven axial vane wheel 24 can be operated via the flow duct 26. Fig. 4 shows a further embodiment, in which the flow duct 26 is connected to a pump 31 via a pipeline 30 and issues through a suction-intake orifice 32 in the lower region of the vessel 2.

Operation is as follows:
During the rotational movement of the filter device 1, filtrate from the vessel 2 is sucked in via the vacuum pump 22, penetrates via the filters of the filter elements 4 and is discharged via suction-extraction lines 16, duct strips 17, pipelines 18, connecting ducts 19, the sliding ring 20 and the pipeline 21. The filter liquid in the vessel 2 is kept constant via an inflow 33. By means of the flow members provided, a defined flow between the spaced-apart filter elements is generated in the filter liquid via the suction-intake orifices 12, 27, 32, so that the solids attracted by the filter suction effect do not remain adhering to the filters and are constantly entrained by the liquid flow. As a result, during the entire filter operation, an automatic and continuous cleaning effect is achieved, without any action of wear on the filters. In addition to a relatively low investment outlay, as compared with conventional generic filter devices, the

energy outlay is in this case also markedly reduced and the efficiency of the filter device is increased. By the avoidance of backwashing and intensive cleaning by means of clarified water, the filter capacity is increased.

Patent claims

1. A filter device (1) for the clarification of contaminated liquids, in particular of sewage, consisting of a plurality of disk-shaped filter elements (4) which are spaced apart from one another and which are combined into circular or polygonal filter modules (3) and are arranged rotatably about a horizontal axis in a vessel (2) containing the unclarified liquid, the filtrate being capable of being discharged via the individual filter modules (3), characterized in that the filter modules (3) form centrally a cavity (14) which on one side is closed by means of a carrying disk (6) and on the other side is connected to the vessel (2) via a suction-intake orifice (12), and in that the cavity (14) is connected operatively to a flow member in such a way that, via the suction-intake orifice (12), a flow can be generated in the unclarified liquid between the spaced-apart filter elements (4) and avoids an adhesion of solids to the filter elements.

2. The filter device as claimed in claim 1, characterized in that the filter modules (3) are lined up on rods (8) and are supported, on the one hand, in a bearing (11) via a driveshaft (10) connected firmly to the carrying disk (6) and, on the other hand, in a bearing (13) via a bearing flange (7) having the suction-intake orifice (12).

3. The filter device as claimed in claims 1 and 2, characterized in that the flow member is designed as a pump vane wheel (15) and is connected to the driveshaft (10) via the carrier plate (6) connected to the filter modules (3).

4. The filter device as claimed in claims 2 and 3,

characterized in that an axial vane wheel (24) connected to a separate motor (25) is arranged in the suction-intake orifice (12) of the bearing flange (7).

5. The filter device as claimed in claims 2 to 4, characterized in that a flow duct (26) is inserted through the suction-intake orifice (12) of the bearing flange (7) and is fastened in a support bearing (28), the flow duct (26) being connected, on the one hand, to the vessel (2) by means of a suction-intake orifice (27) and, on the other hand, to the cavity (14) by means of a slot-shaped orifice (29).

6. The filter device as claimed in claim 2, characterized in that a flow duct (26) is inserted through the suction-intake orifice (12) of the bearing flange (7) and is fastened in a support bearing (28), the flow duct (26) being connected by means of a suction-intake orifice (27) to a pipeline (30) which issues with a suction-intake orifice (32) below the filter device (1) on the vessel (2), and a liquid pump (31) being integrated into the pipeline (30).

Fig. 1

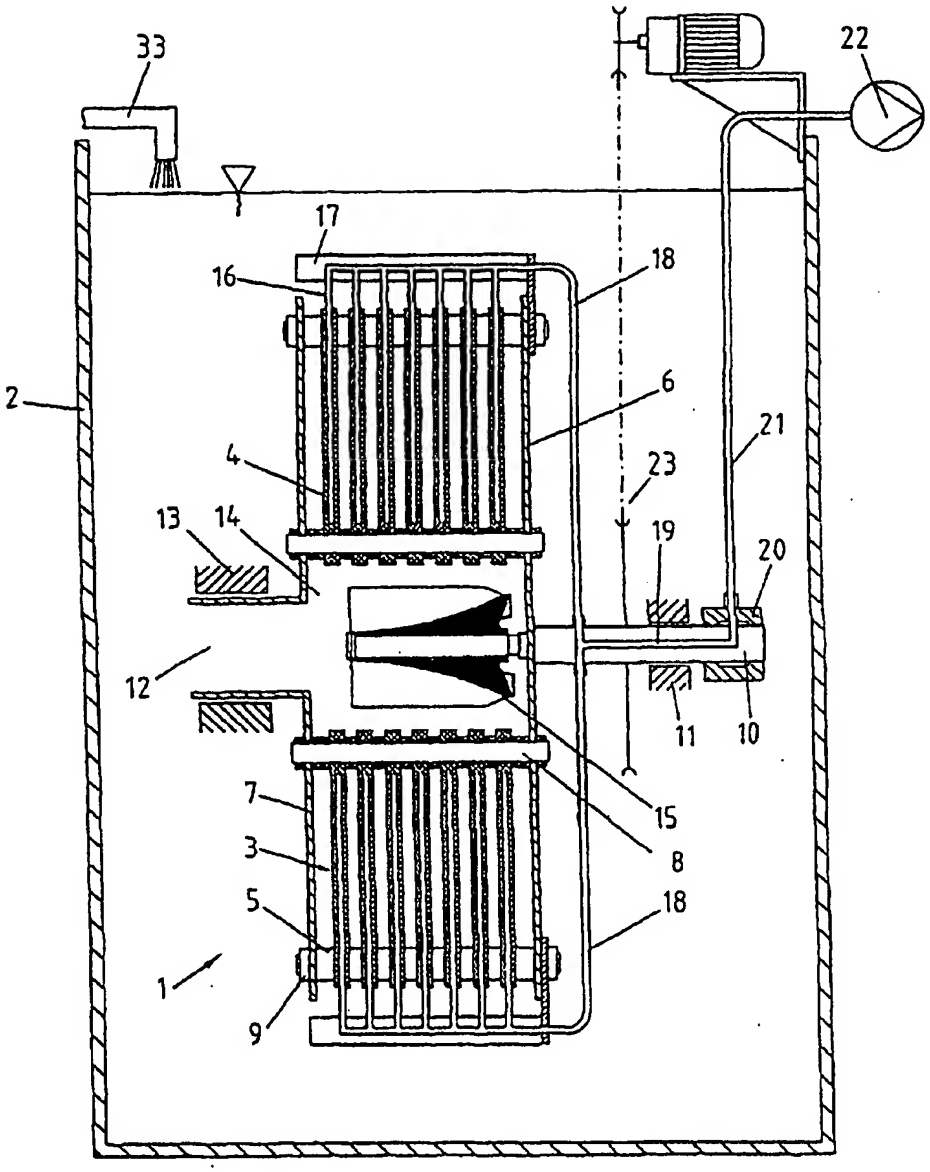

Fig. 2

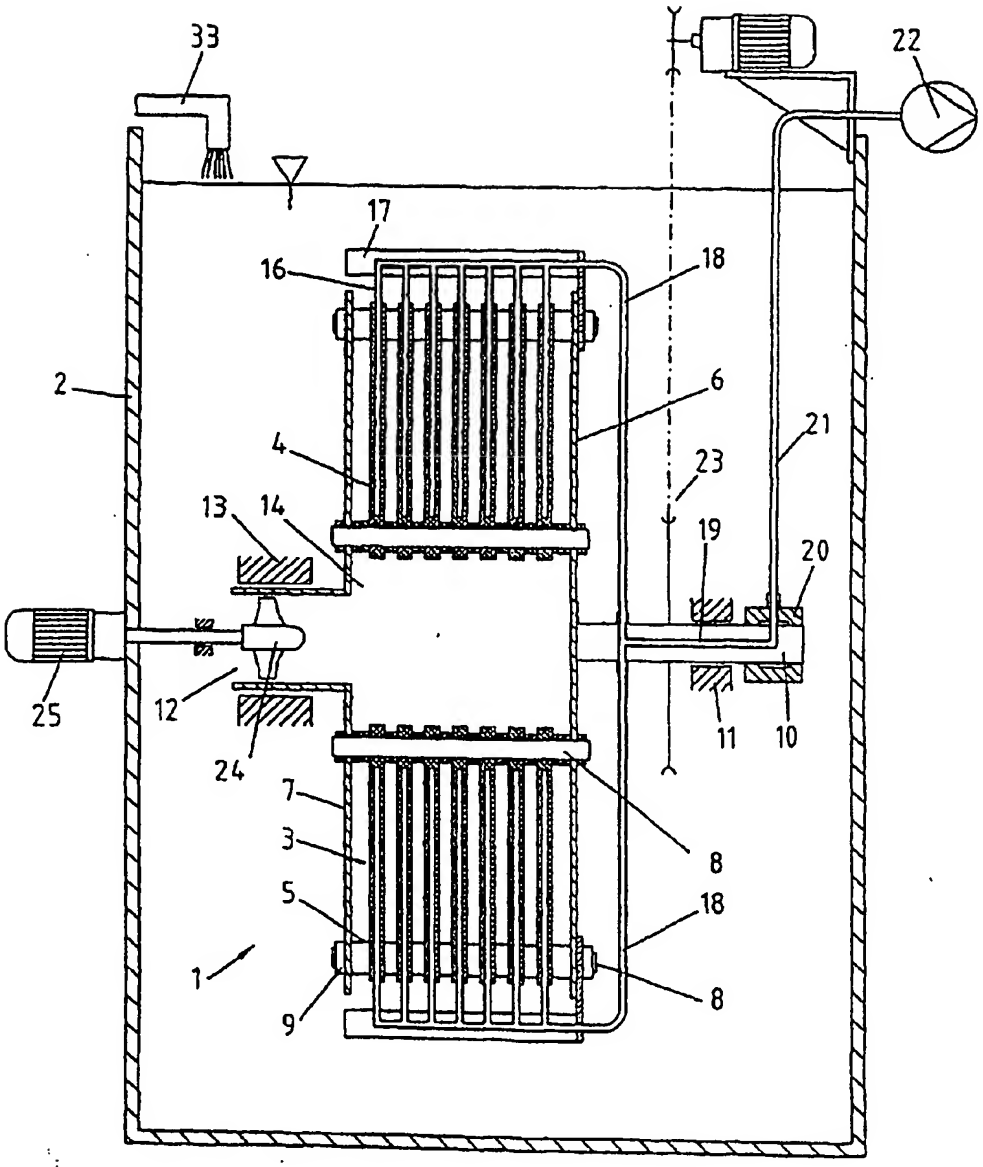

Fig. 3

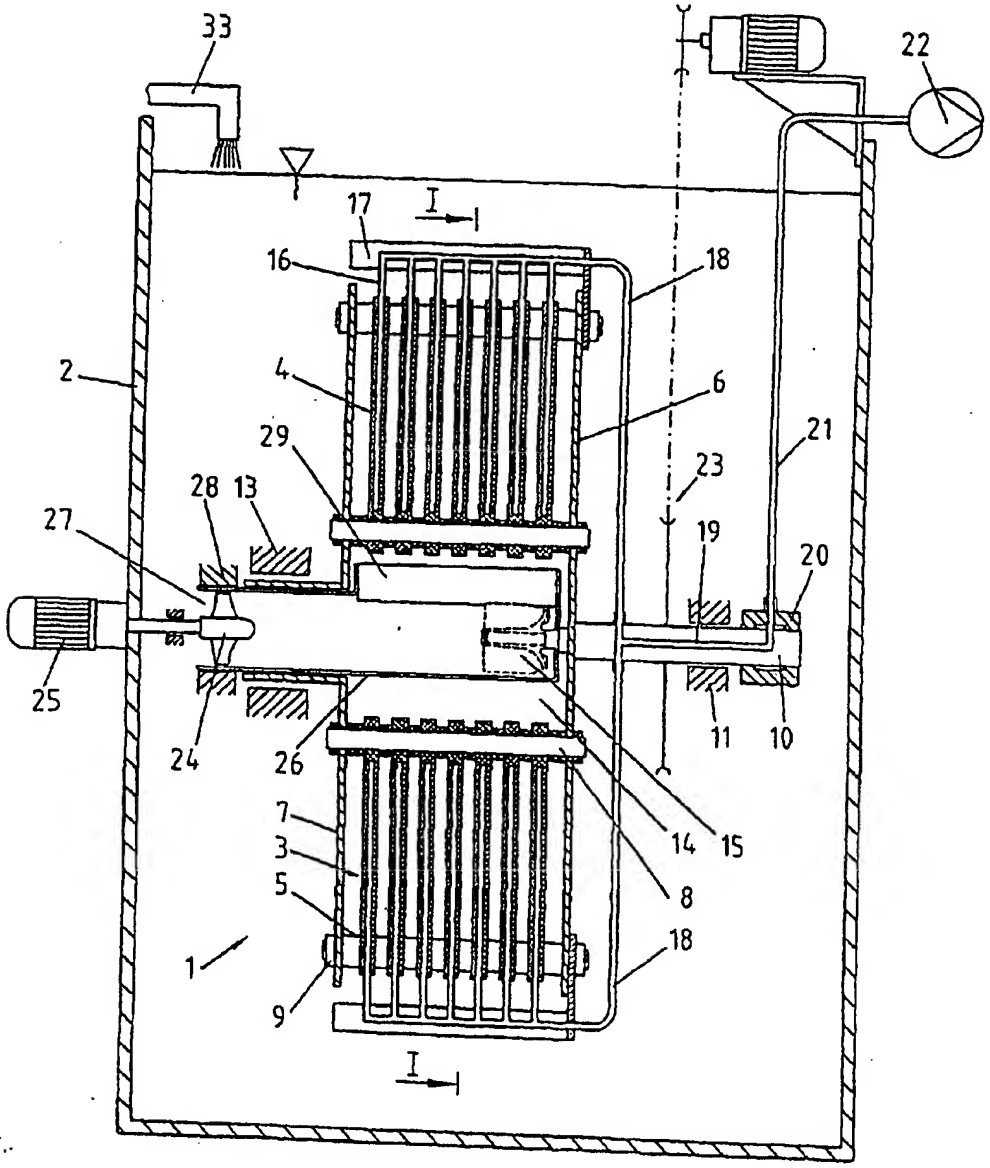
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Fig. 4

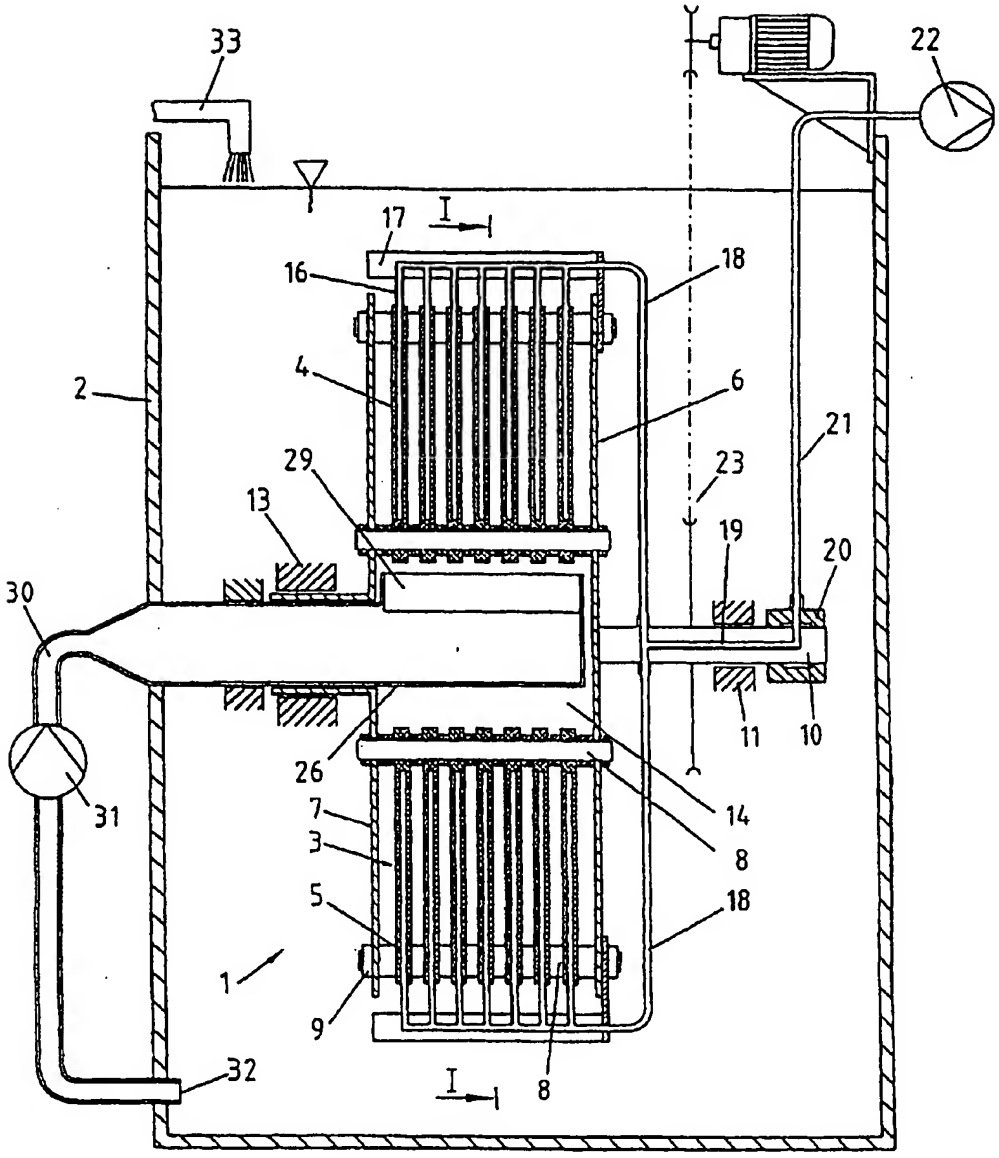
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Fig. 5